REMARKS

The Examiner has withdrawn Claim 57 from consideration as being directed to a non-elected invention. In compliance with the Examiner's position, Claim 57 has been canceled.

The Examiner has rejected Claims 1-6 and 14 under 35 USC 102(b) as being anticipated by Gudin (U.S. Patent No. 5,179,021). Specifically, the Examiner has taken the position that Gudin specifically teaches a phase separation, with or without using an aqueous solvent, whereby the lipid phase is separated from solid cellular residues in the aqueous phases (column 4, lines 10-20). The Examiner has further taken the position that applicant's prior arguments that the references fail to show certain features of applicant's invention were not convincing because the features upon which applicant relied were not recited in the rejected claims.

The Examiner's rejection of Claims 1-6 and 14 is respectfully traversed.

Claim 1 has been amended to clarify that the claimed invention is a solventless extraction process. Specifically, the phrase "using a solventless extraction process" has been added to step (b) of Claim 1, which now reads "(b) treating said lysed cell mixture using a solventless extraction process to produce a phase separated mixture comprising a heavy layer and a light layer, wherein said heavy layer comprises an aqueous solution and said light layer comprises said lipid." Support for this amendment can be found at page 6, line 15 through 20 and Claim 52. The term "solventless extraction process" is defined as a substantially organic solvent-free extraction process where the aqueous solvent includes less than about 5% of an organic solvent. This amendment does not raise any new issues as this limitation was already included in dependent Claim 52. Therefore, it is entirely appropriate for the Examiner to consider this clarification to Claim 1 after issuance of the final Office Action.

In order for a reference to anticipate under 35 USC 102 (b), the reference (i.e., Gudin) must disclose all the elements of the claim. It is respectfully submitted that Gudin does not disclose all the elements of independent Claim 1, and therefore does not anticipate Claim 1 or Claims 2-6 and 14, which are dependent on Claim 1. Gudin discloses a solvent extraction process which directly teaches away from the present invention. Because the present process does not involve solvent extraction, organic solvents are not required. If any organic solvents are present, they may function as a process aid, at a concentration less than 5% of the aqueous solvent. The Gudin solvent

extraction process is very standard regarding solvent use and those skilled in the art would know that it would require about 2 parts solvent to 1 part culture media to have effective recoveries -- this is 200% compared to less than 5%. This is a clear, patentable distinction between the present claimed invention and the cited reference. Further, Gudin does not teach the presence of a lipid in a light layer, as is required by Claim 1.

More specifically, Gudin teaches a straightforward solvent extraction process (see column 2, lines 51-53; column 4, lines 3-21 and column 5, line 56-column 6, line 11). In a solvent extraction process, the desired product (in the case of Gudin, antioxidants) preferentially migrates to the desired solvent phase and can be separated and recovered. In other words, the solvent extraction process of Gudin results in a phase containing the cellular debris and one or two phases comprising the added solvent(s) and the product(s) which preferentially migrate to the solvent(s). On the other hand, the present invention involves a straightforward density separation. The desired product (lipid) is efficiently and effectively separated from the fermentation broth, e.g., by centrifugation. While additives, such as alcohols, may aid in the separation, the present invention is a density separation, not a solvent extraction. As a result, the cellular debris is in the aqueous phase, and the desired lipid product is in its own lipid-rich phase, rather than dissolved or dispersed in an added solvent phase. The lipid-rich phase produced by the present invention can be subjected to further refining and/or polishing. The present process has a number of important advantages, including simplicity, efficiency and effectiveness. For example, the fermentation broth can be treated directly, without drying the microorganisms. Drying or substantially dewatering the microorganisms, a process step that can comprise up to 30% of the oil recovery costs depending on the process used, is a necessary requirement for the solvent-based process proposed by Gudin.

It is respectfully submitted that the solvent extraction process of Gudin does not anticipate the solventless extraction process of the present claimed invention. Therefore, it is respectively submitted that the Examiner's rejection under 35 USC 102 has been obviated and should be withdrawn.

The Examiner has rejected Claims 1-10, 12-19 and 47-56 under 35 USC 103(a) as being unpatentable over Gudin in view of Barclay (US Patent No. 5,130,242). The Examiner has taken the position that applicant's prior arguments that the references fail to show certain features of

applicant's invention (i.e., the high pH) were not convincing because the features upon which applicant relied were not recited in the rejected claims. The Examiner also states: "Although Barclay does not teach each of the [sic-word appears to be missing] as claimed in 47-56, it would have been obvious to one of ordinary skill in the art to optimize the volume of solvent and/or the amount of water in the cells because it was routine practice in the art at the time the claimed invention was made."

The Examiner's rejection of Claims 1-10, 12-19 and 47-56 is respectively traversed.

Due to the deficiencies of Gudin as a reference, set forth above, the Examiner's rejection under 35 USC 103 based on the combination of Gudin and Barclay has been obviated. In addition, regarding the Examiner's comment that the high pH limitation is not recited in the rejected claims, the Examiner is respectfully directed to Claim 10. Although Claim 10 does not recite the pH level, it does require "solubilizing at least part of proteinaceous compounds in a fermentation broth." Barclay teaches growing cells at pH 4-8.5 to maximize production, that is very different than the pH's achieved when adding a base to solubilize a portion of the proteins. The pH employed to solubilize a portion of the proteins is above pH 9, and preferably greater than pH 10 or pH 11, which is above the pH where the vast majority of microorganisms can grow or survive (in part due to the hydrolysis of proteins necessary for life and interruption of biochemical processes). The present application teaches destruction of the proteins because the inventors identified them as key components maintaining the emulsion of oil and water that hinders recovery of the lipids.

Applicant agrees with the Examiner's comment that Barclay does not teach that which is claimed in Claims 47-56. However, applicant strongly disagrees with the Examiner's position that it would have been obvious to one of ordinary skill in the art to optimize the volume of solvent and/or the amount of water in the cells because it was routine practice in the art at the time the claimed invention was made. Not only is there no support for this statement, but Barclay teaches away from the claimed invention. Barclay teaches solvent extraction processes, such as using hexane. Optimizing the amount of hexane one can use in a solvent extraction process would never lead one to the extremely low (or nonexistent) amounts of solvent used in the present claimed solventless extraction process. Therefore, Barclay directly teaches away from the present claimed invention.

There are further specific differences between the claims and the processes taught by Gudin and Barclay. Claims 10 requires that at least a portion of the proteinaceous compounds in the fermentation broth be solubilized, which is not specifically taught by Gudin. The present application teaches destruction of the proteins because the inventors identified them as key components maintaining the emulsion of oil and water that hinders recovery of the lipids. On the other hand, Gudin tries to recover the proteins. SOD is an enzyme (protein) so Gudin uses conditions that protect the proteins (e.g., 4C temperature, ammonium sulfate precipitation) and does not denature or hydrolyze them. The conditions of the present invention focus on an economic method for recovery of the lipids, and include hydrolysis and denaturing of the proteins. In Claim 51, the process is conducted without drying the cells and in Claims 53-56, the microorganisms contain from at least 10%, up to at least 50%, entrained water. On the other and, Gudin employs a rotary filter (#7) to dewater the cells (see column 5, lines 25-49 and Figure 1).

It is respectfully submitted that the Examiner's rejection of Claims 1-10, 12-19 and 47-56 has been obviated, and it is respectfully requested that the Examiner's rejection be withdrawn.

The Examiner has rejected Claims 1-9, 11 and 14 under 35 USC 103(a) as being unpatentable over Gudin in view of Wagner (US Patent No. 5,720,456).

The Examiner's rejection of Claims 1-9, 11 and 14 is respectively traversed.

Wagner does not overcome the deficiencies and inadequacies of Gudin as a reference. For example, Claim 11 requires heating the cells to at least 50C, while Gudin teaches a temperature of 4C (column 4 lines 23-27). Gudin heats the cells briefly to 40C to "permeablize" the cells and let the water-soluble antioxidants leak out into the culture medium where they can be concentrated, purified and recovered. Gudin then uses a centrifuge/rotary drum filter to recover the cells and process them for the lipid related antioxidants. On the other hand, Claim 11 claims heating above 50C to lyse the lipid rich cells -- and the cells do not have to be recovered. There is no motivation or suggestion to combine the teachings of Gudin and Wagner, and even if combined, the two prior art solvent extraction processes would not render the present claimed solventless extraction process obvious.

It is respectfully submitted that the Examiner's rejection of Claims 1-9, 11 and 14 has been obviated, and it is respectfully requested that the Examiner's rejection be withdrawn.

As a result of the substantial differences between the cited art and the present invention, the claimed process is much simpler, less expensive and more efficient than the cited art, and in particular, Gudin. As a simple example, referring to Figure 1 in Gudin , the present claimed process only requires the culture vessel and the centrifuge (#4 and #18), and the other major process steps and equipment illustrated in Figure 1 are not required.

It is respectfully submitted that all of Claims 1-19 and 47-56 are in condition for allowance, and that the present case should be passed to issue. In the event that the Examiner has any questions or concerns regarding the allowability of any claim, please consider this a provisional request for an Examiner's interview and please contact the undersigned agent at 303-863-9700.

Respectfully submitted,

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In the Claims:

Claim 57 has been canceled.

Claim 1 has been amended as shown below.

1. (Once Amended) A process for obtaining lipid from microorganisms comprising:

(a) lysing cells of the microorganisms to produce a lysed cell mixture;

(b) treating said lysed cell mixture using a solventless extraction process to produce a phase separated mixture comprising a heavy layer and a light layer, wherein said heavy layer comprises an aqueous solution and said light layer comprises said lipid;

(c) separating said heavy layer from said light layer; and

(d) obtaining said lipid from said light layer.